4.2.10 Hot Cell Design

4.2.10.1 Hot Cell function and specifications

The purpose of the NuMI Target Hall Hot Cell (also known as the Work Cell) is to provide a well-shielded facility for repairing or replacing NuMI target and horn assemblies that have developed faults during operation. In normal NuMI beamline operation these components are mounted on steel framework structures called "modules" that provide mechanical support, utility connections and precise positioning. (A single module serves both the production target and the upstream baffle assembly.) The target and horn assemblies and their modules become intensely radioactive during beamline operation. The modules are designed to be reused (there are no spares) but a failed target or horn assembly will usually be replaced with a spare because it will be too radioactive for repairs to be practical.

The Hot Cell provides facilities for performing the following operations with minimal radiation exposure to the personnel involved:

1. Place a failed target or horn assembly, mounted on its module, in the hot cell using the overhead bridge crane. The upstream steel door of the Hot Cell must be opened and closed by remote control during this operation.

2. Install top shield cover, except at end-wall and stripline penetrations, to allow personnel access to top of module.

3. Repair the failed component or detach it from its module if repairs are not possible.

4. In the case where repairs are not possible, remove the module and the failed component separately from the Hot Cell. (The module is temporarily returned to the target chase and the horn or target assembly is placed in the morgue.)

5. Move a replacement target or horn into the Hot Cell and place it on the lifting table.

6. Move the module into the Hot Cell and use the lifting table to align the component accurately relative to the module.

7. Make the required mechanical connections between the module and component.

8. Test utility lines and connections (water, vacuum, instrumentation) of the module-component assembly.

9. Remove the module-component assembly from the Hot Cell and reinstall it in the target chase.

4.2.10.2 Hot Cell design

The Hot Cell consists of the following major components:

1. Three-foot thick concrete shield-block side walls (East and West).

2. One-foot thick steel end walls (North and South). The South wall is remotely movable. It opens by sliding to the East on upper and lower rails with Hillman rollers.

3. Rails for supporting target and horn modules in the same way they are supported in the target chase.

4. Electrical power for South door, lifting tables, etc.

5. A remotely controlled Lifting Table (also known as the Motion Table) that provides x-y-z positioning capability for aligning the horn or target relative to the module before the two are mechanically connected. The system provides position ranges of: x = ±6 inches, y = 0 to 25 inches, z= ±9 inches.

6. Three apertures in the East concrete side wall that are filled with (manually) removable lead bricks and lead-glass blocks. The lead-glass blocks allow workers to view the connections between the component (target or horn assembly) that must be disconnected or connected by remote control.

7. A fourth aperture, located in the downstream (North) steel end wall is also filled with removable lead bricks and lead-glass blocks. This provides a view of the connection between the horn and the stripline flexible joint as well as access to that joint if a stripline needs to be disconnected from a horn.

8. Removable steel cover plates that provide radiation shielding and personnel access to the top of the Hot Cell after a module assembly has been placed inside.

9. Note: the Hot Cell structure is built on the same 3.5-degree slope as the target chase so that the module can be supported in the same manner in both locations.

10. Note: the mechanical, water and electrical connections between a module and its target or horn assembly are made from the top of the Hot Cell by way of the same penetrations,

through the module end walls and stripline-penetration shielding block, that are used when the module is installed in the target chase.

11. Note: transportation and lifting fixtures for moving and installing the steel doors and the concrete shield blocks of the Hot Cell are included in the Hot Cell construction task.

Most of the figures that follow are derived from current engineering drawings of the Hot Cell and its components. They are intended only to illustrate the major design features of the device and should not be used to obtain exact specifications or dimensions.

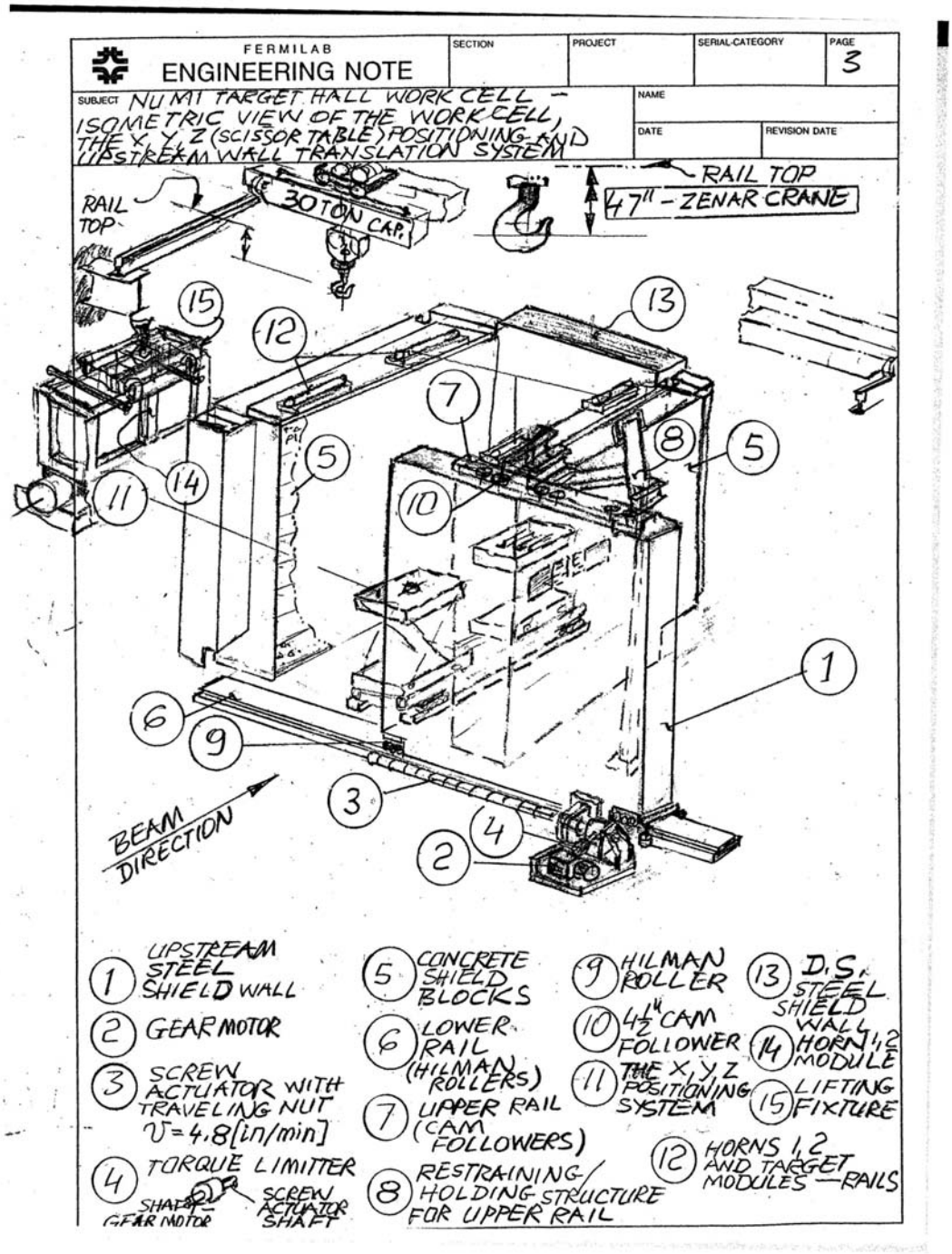

Figure 4.2-30 Sketch of the main Hot Cell components.

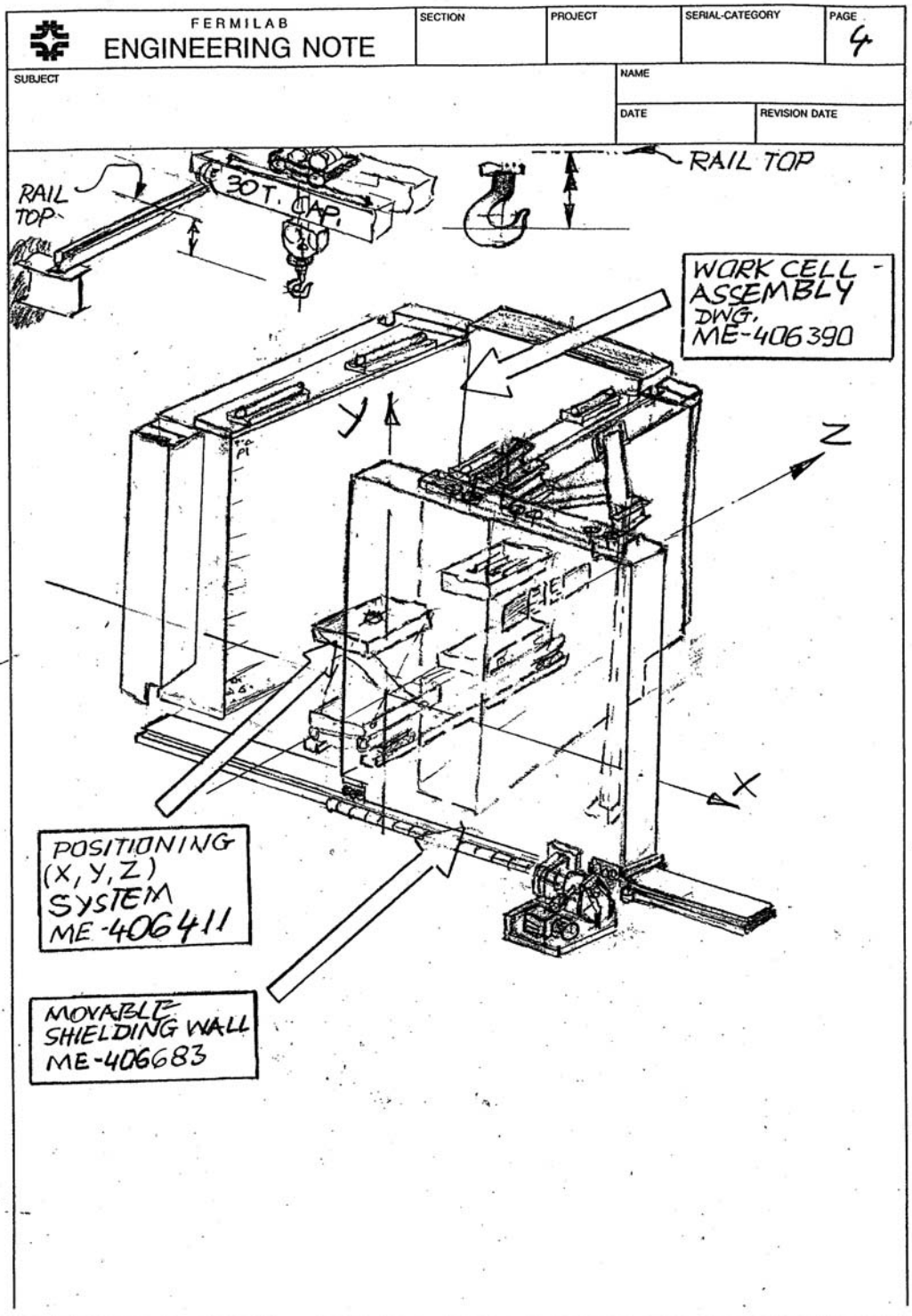

Figure 4.2-31 Hot Cell sketch showing coordinate systems and drawing numbers.

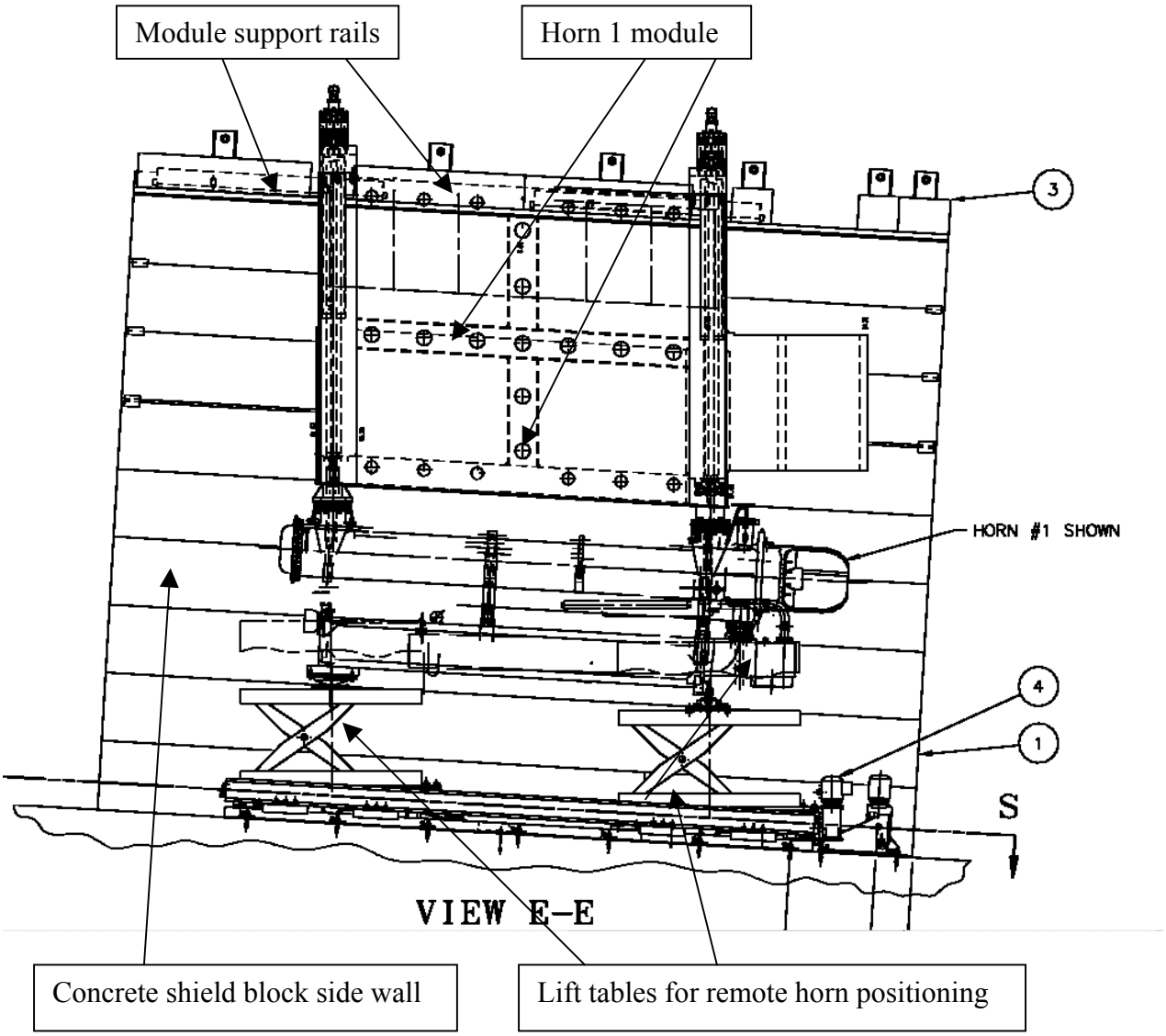

Figure 4.2-32 Side elevation view of the Hot Cell assembly with Horn 1 module installed.

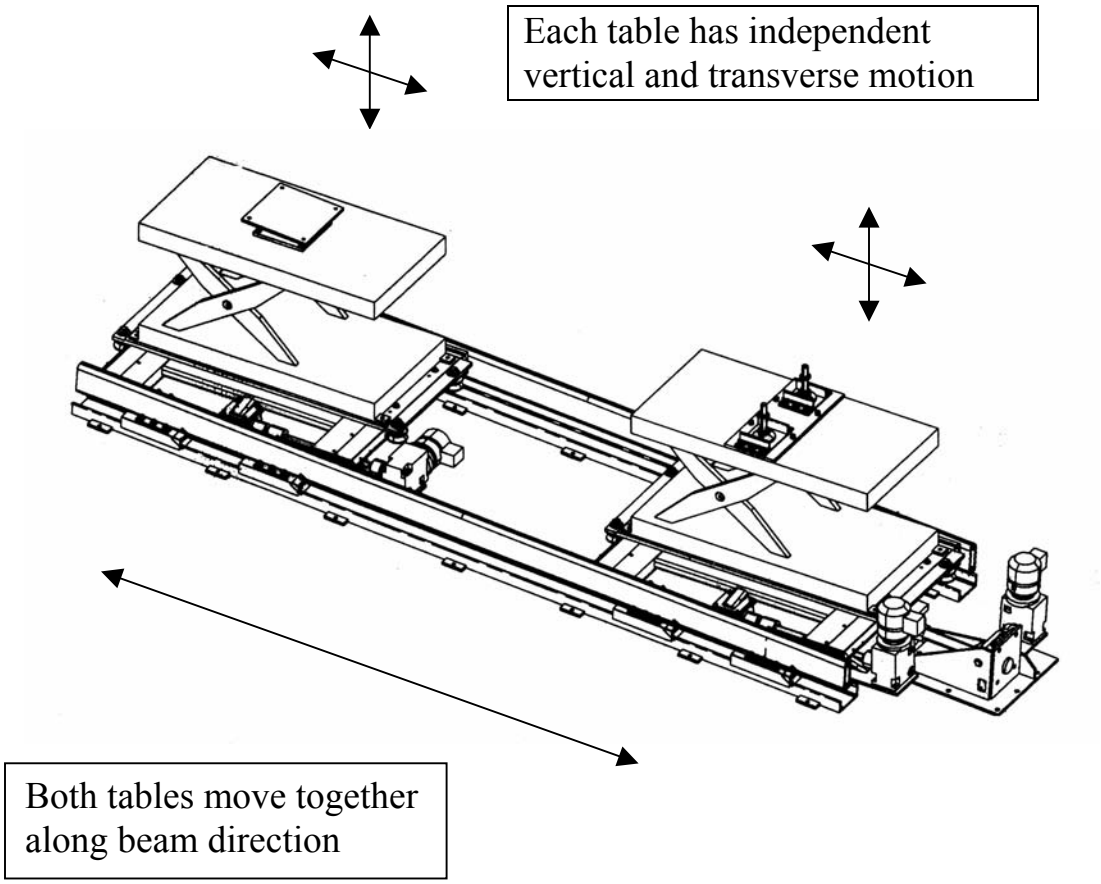

Figure 4.2-33 Sketch of Lifting Table.

	29	MD-406576	TRACK - BASE PLATE 1	2	
	28	MD-406589	WALKWAY-RAILING BRACKET ASSEMBLY A	8	
	27	MD-406593	WALKWAY ASSEMBLY	1	
	26	MC-406585	WALKWAY - KICKER SUPPORT ASSEMBLY #2	3	
	25	MC-406579	WALKWAY - KICKER SUPPORT ASSEMBLY #1	2	D
A	24	FURNISHED	GLASS BRICK (6 x 6 x 18)	6	
	23	COML.	FERRY HD SCREW, 3/8-16UNC-2A x 1 LG. S.S. 304, CAP SCREW HEX.HD.	36	
	22	COML.	HILTI HDI 3/8 DROP-IN ANCHOR ITEM NUMBER 0045731	36	
	21	COML.	PIPE, 1 1/2 SCH. 40 x 37.00 LG., ALUMINUM E6061-T6	4	

Table 4.2-16a Key to numbered components in drawings that follow.

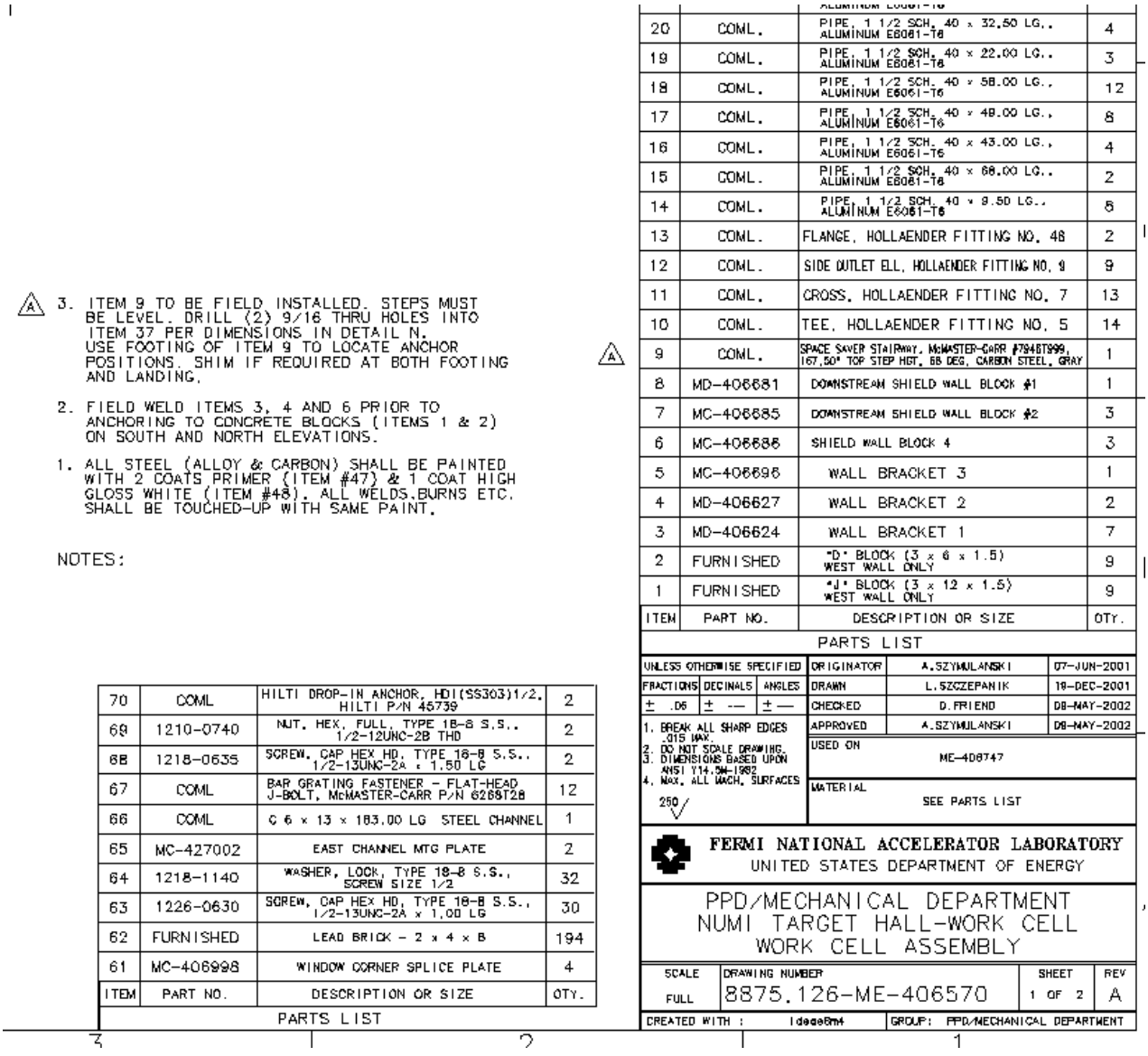

Table 4.2-16b Key to numbered components in drawings that follow (continued)

60	MC-406997	WINDOW FRAME SPLICE PLATE	4
59	MC-406996	VERTICAL WINDOW FRAME SECTION	2
58	MC-406995	HORIZONTAL WINDOW FRAME SECTION	2
57	MC-406993	STOP BRKT SPLICE PLATE	2
56	COML.	HOT ROLLED FLAT, 1/2 x 4 x 3.00 LG. CARBON STEEL ASTM A-36	2
55	COML.	HOT ROLLED FLAT, 1/2 x 4 x 2.00 LG. CARBON STEEL ASTM A-36	9
54	COML.	HOT ROLLED FLAT, 1/4 x 4 x 3.00 LG. CARBON STEEL ASTM A-36	2
53	COML.	HOT ROLLED FLAT, 1/4 x 4 x 2.00 LG. CARBON STEEL ASTM A-36	9
52	COML.	SHIMS - LEAD	AS REQD
51	———	———	—
50	MC-406992	LEAD GLASS STOP BRKT WELDMENT	4
49	COML.	1 x 3 x 4.00 LG. ASTM A 36 STEEL FLAT	2
48	1825-3750	PAINT, HIGH GLOSS WHITE RUSTOLEUM #27881	AS REQ'D
47	1825-4000	PAINT, RED PRIMER RUSTOLEUM #768	AS REQ'D
46	COML.	WASHER, FLAT, ALLOY STEEL FOR 5/8" BOLT	32
45	COML.	CAP SCREW, HEX. HD, ALLOY STEEL 5/8-11UNC-2A x 2.00 LG.	32
44	COML.	HILTI KWIK BOLT, 5/8 x 4 3/4 LG. HILTI #000453712	48
43	COML.	C 6 x 13 x 225.00 LG STEEL CHANNEL	1
42	MC-406651	WALL BRACKET	4
41	COML.	1/2 x 3 x 182.00 LG STEEL ANGLE	2
40	COML.	3/8 FLAT WASHER	40
39	COML.	CONCRETE GROUT, HIGH STRENGTH MASTERFLOW 928, ASTM C-1107	AS REQ'D
38	ME-406748	EAST WALL ASSEMBLY	1
37	MD-406750	KICKER SUPPORT ASSY 3	1
36	COML.	HILTI KWIK BOLT 3/4 x 8" ITEM # 000453738	10
35	COML.	1/2-13 UNC x 5.50 LG. HILTI S.S. KWIK BOLT ITEM NO. 000453936	32
34	COML.	5/8-11 UNC x 7.00 LG. HILTI KWIK BOLT ITEM NO. 000453738	83
33	COML.	FLAT WASHER FOR 7/8 BOLT ALLOY STEEL	24
32	COML.	7/8-9 UNC-2A x 8.75 LG. HEX. BOLT ALLOY STEEL	24
31	MC-406582	TRACK - WELDMENT	4
30	MD-406578	TRACK - BASE PLATE 2	2
29	MD-406576	TRACK - BASE PLATE 1	2
28	MD-406589	WALKWAY-RAILING BRACKET ASSEMBLY A	8
27	MD-406593	WALKWAY ASSEMBLY	1
26	MC-406585	WALKWAY - KICKER SUPPORT ASSEMBLY #2	3

Table 4.2-16c Key to numbered components in drawings that follow (continued)

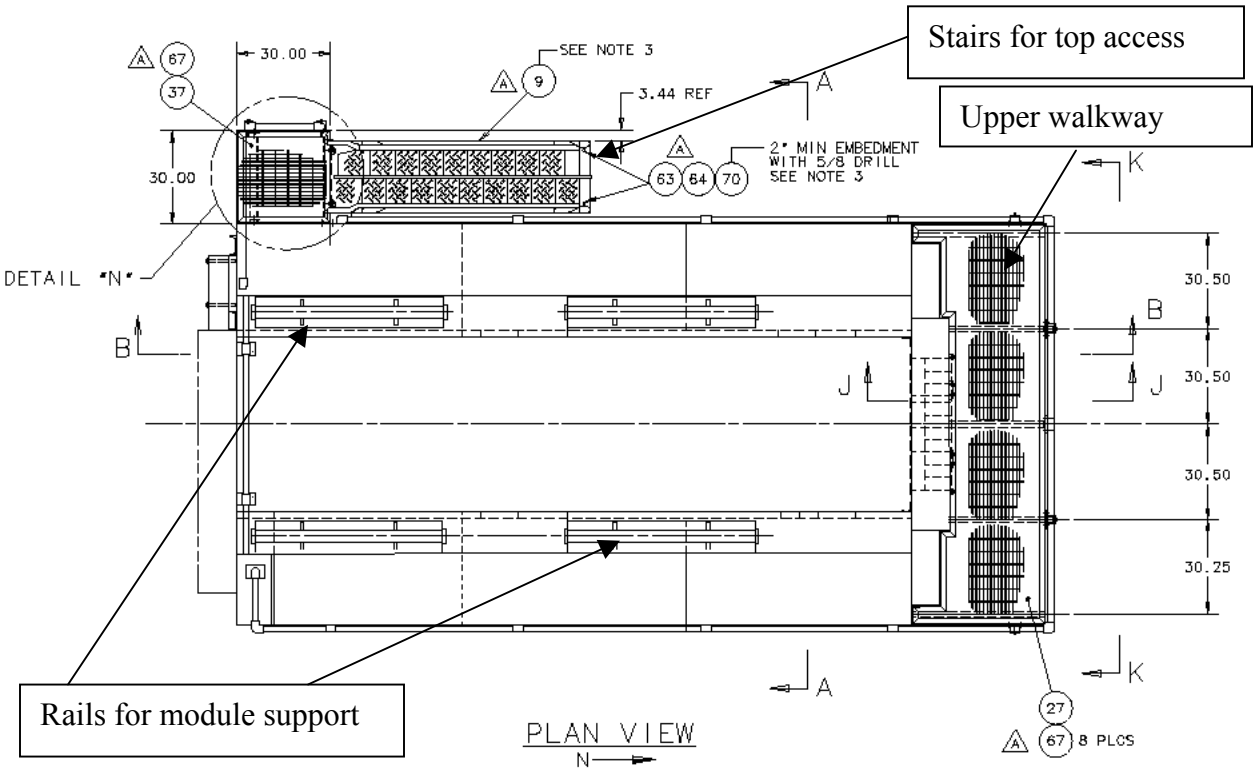

Figure 4.2-34a Plan view of the Hot Cell assembly.

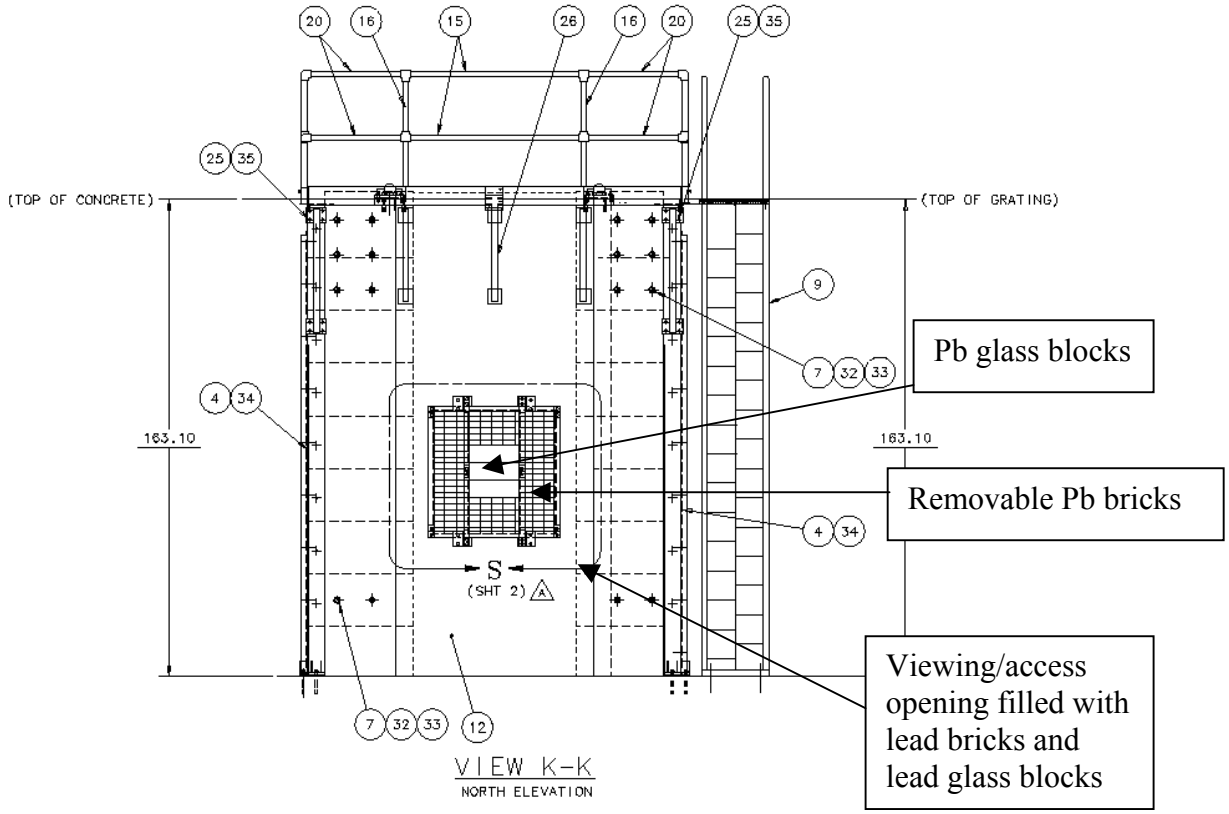

Figure 4.2-34b North end elevation of the Hot Cell assembly.

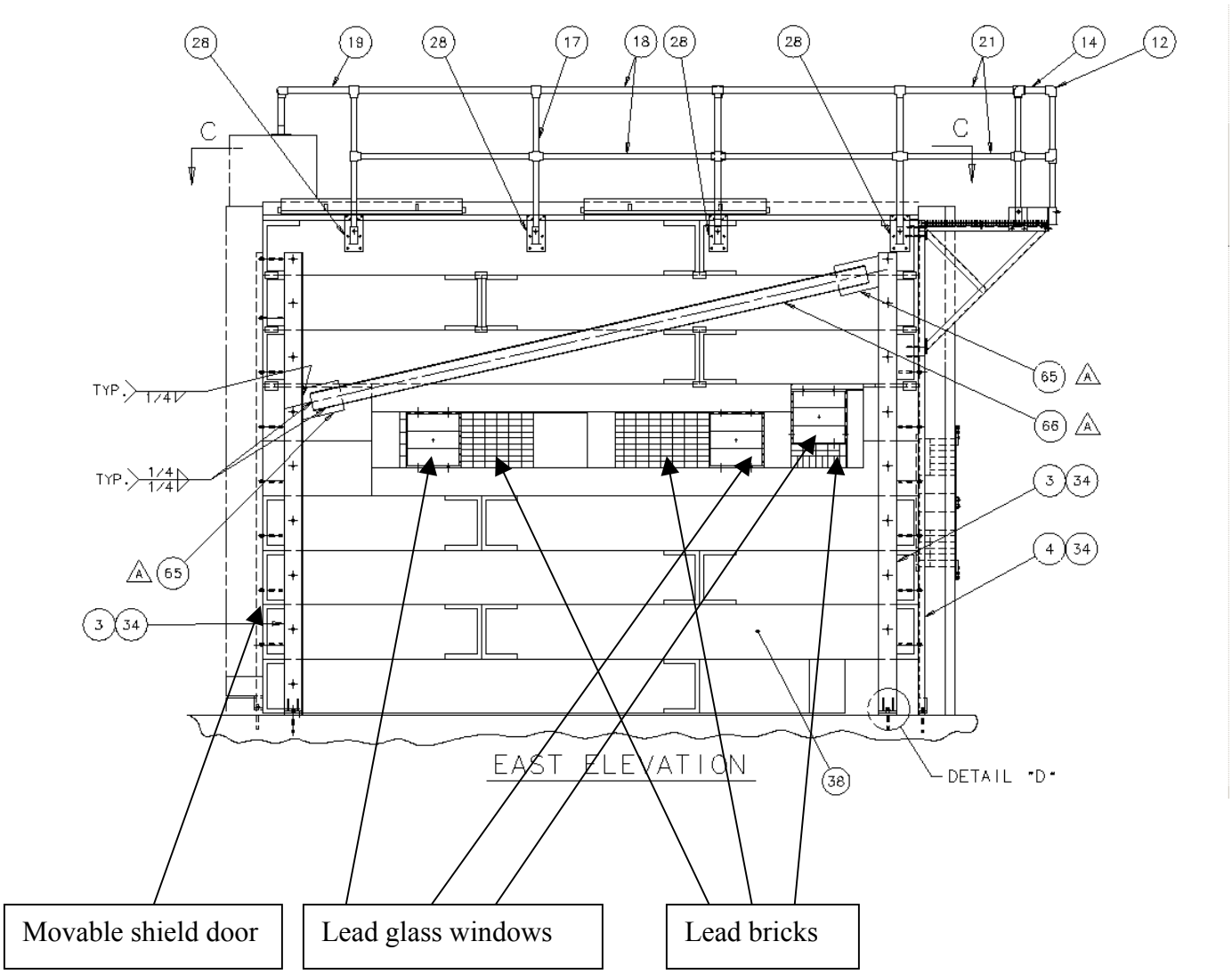

Figure 4.2-34c-Side elevation view of East wall of Hot Cell.